

**CLAIMS**

We claim:

1. An apparatus for electrolytic purification of brackish water, said apparatus comprising:  
a photovoltaic device, said photovoltaic device converting solar energy to electricity, said  
5 photovoltaic device comprising at least one triple junction solar cell;  
an anode in electrical communication with said photovoltaic device and said anode in  
contact with said brackish water,  
a cathode in electrical communication with said photovoltaic device and said a cathode in  
contact with said brackish water, said solar energy causing the generation of an  
10 electric potential between said anode and said cathode; said electrical potential  
inducing a water splitting reaction of said brackish water, said water splitting reaction  
producing hydrogen gas and oxygen gas, said hydrogen gas and said oxygen gas  
evolving from said brackish water; and  
a reaction chamber, said reaction chamber receiving said hydrogen gas and said oxygen  
15 gas, said hydrogen gas and said oxygen gas reacting spontaneously in said reaction  
chamber to form water.

2. The apparatus of Claim 1, further comprising means for collecting said hydrogen gas and  
means for collecting said oxygen gas.

3. The apparatus of Claim 2, said means for collecting said hydrogen gas comprising a  
hydrogen gas conduit, said hydrogen gas conduit collecting said hydrogen gas and transporting  
said hydrogen gas to said reaction chamber, said means for collecting said oxygen gas

comprising a oxygen gas conduit, said oxygen gas conduit collecting said oxygen gas and transporting said oxygen gas to said reaction chamber.

4. The apparatus of Claim 1, said brackish water comprising ocean water.

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5. The apparatus of Claim 1, said electrical potential comprising at least 1.23 V.

6. The apparatus of Claim 1, further comprising a hydrogen purification system, said hydrogen purification system purifying said hydrogen gas.

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7. The apparatus of Claim 6, said hydrogen purification system comprising:

a gas receiving chamber adapted to receive a gaseous stream of impure hydrogen, said gaseous stream of impure hydrogen comprising said hydrogen gas produced from said brackish water;

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an alkaline solution;

a source of power for providing an electrical current;

a gas diffusion anode adjacent to said gas receiving chamber having a gas interface in contact with said gaseous stream of impure hydrogen and an electrolyte interface in contact with said alkaline solution, wherein hydrogen from said gaseous stream of impure hydrogen is absorbed into said gas diffusion anode;

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an electrolytic cathode in contact with said alkaline solution adapted to receive said electrical current and to produce a supply of hydrogen upon receipt of said electrical current.

8. The apparatus of Claim 7, said gas receiving chamber comprising:  
an input for receiving said gaseous stream of impure hydrogen; and  
an output for venting an outlet stream containing contaminants from said stream of  
5 impure hydrogen and hydrogen not absorbed by said gas diffusion anode.

9. The apparatus of Claim 8, said outlet stream fed into a hydrogen separator adapted to  
separate said outlet stream into a hydrogen stream containing mostly hydrogen and a waste  
stream containing mostly contaminants.

10. The apparatus of Claim 9, said hydrogen stream fed into said impure hydrogen stream  
and said waste stream is vented to the atmosphere or collected.

11. The apparatus of Claim 1, said triple junction solar cell comprising a triple junction  
15 amorphous silicon solar cell.

12. The apparatus of Claim 1, said reaction chamber having reaction chamber electrodes, said  
spontaneous reaction causing an electric potential to develop between said reaction chamber  
electrodes.

13. The apparatus of claim 12, said electric potential of said reaction chamber electrodes  
providing electrical energy to said brackish water.

14        An apparatus for the production of hydrogen gas from brackish water, said apparatus comprising:

          a photovoltaic device, said photovoltaic device converting solar energy to electricity, said photovoltaic device comprising at least one triple junction solar cell;

5        an anode in electrical communication with said photovoltaic device and said anode in contact with said brackish water,

          a cathode in electrical communication with said photovoltaic device and said a cathode in contact with said brackish water, said solar energy causing the generation of an electric potential between said anode and said cathode; said electrical potential inducing a water reduction reaction of said brackish water, said water reduction reaction producing hydrogen gas, said hydrogen gas evolving from said brackish water.

15.       The apparatus of Claim 14, further comprising a hydrogen storage material, said hydrogen storage material absorbing said hydrogen gas, said hydrogen storage material storing said hydrogen gas.

16.       The apparatus of Claim 15, said hydrogen storage material comprising  $A_2B$ ,  $AB_2$ ,  $AB_5$  or a mixture thereof.

20        17.       A method for the electrolytic purification of brackish water, comprising:  
          contacting said brackish water with an anode;  
          contacting said brackish water with a cathode;

applying an electric potential across said anode and said cathode, said electric potential  
supplied by a photovoltaic device in electrical communication with said anode and  
said cathode, said electric potential inducing a water splitting reaction of said  
brackish water, said water splitting reaction producing hydrogen gas and oxygen gas,  
5 said hydrogen gas and said oxygen gas evolving from said brackish water;  
transferring said hydrogen gas to a reaction chamber;  
transferring said oxygen gas to said reaction chamber, said hydrogen gas and said oxygen  
gas reacting spontaneously in said reaction chamber to form water.

10 18. The method of Claim 17, further comprising:

collecting said hydrogen gas prior to transferring said hydrogen gas; and  
collecting said oxygen gas prior to transferring said oxygen gas.

19. The method of Claim 17, further comprising purifying said hydrogen gas prior to  
15 transferring said hydrogen gas.

20. The method of Claim 17, said electrical potential comprising at least 1.23 V.